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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/656,001	09/05/2003	Ravi Narasimhan	MP0256	7519

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EXAMINER	
PHAN, HUY Q	

ART UNIT	PAPER NUMBER
2617	

DATE MAILED: 10/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/656,001	NARASIMHAN, RAVI	
	Examiner	Art Unit	
	Huy Q. Phan	2617	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 September 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2,4-11,13,15-22,24,26-33,35,37-44,46,48-55 and 57-59* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *9, 11, 20, 22, 31, 33, 42, 44, 53, 55, 58 and 59* is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The Art Unit location of your application in the USPTO has changed. To aid in correlating any papers for this application, all further correspondence regarding this application should be directed to Art Unit 2617.

Response to Amendment

2. This Office Action is in response to Amendment filed on date: 09/28/2006.

Claims 2, 4-11, 13, 15-22, 24, 26-33, 35, 37-44, 46, 48-55, and 57-59 are still pending.

Response to Arguments

3. Applicant's arguments, see REMARKS, have been fully considered but they are not persuasive.

a) Applicant argued that "Kadous does not disclose or suggest selecting a constellation for transmission on the active antennas where said selecting the constellation for transmission on the active antennas comprises selecting different constellations two or more of the active antennas" (see REMARKS pages 18-24). The examiner respectfully disagrees. Kadous shows that the coded data for each data stream is modulated based on one or more constellation selection (e.g., BPSK, QSPK, M-PSK, or M-QAM) to provide the specific modulation symbol (see fig. 1 and col. 4, lines 31-67). Kadous also teaches that each specific modulation symbol is selected for each transmit antenna (col. 18, lines 15-17). Since the different selected constellations

provide the different modulation symbols (see fig. 5 and col. 17, line 12--col. 18, line 45); therefore Kadous discloses the claimed limitation of "selecting a constellation for transmission on the active antennas where said selecting the constellation for transmission on the active antennas comprises selecting different constellations two or more of the active antennas".

b) Applicant argued that "Koadous does not disclose selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin" (see REMARKS pages 20-24). The examiner respectfully disagrees. Kadous shows that each specific symbol stream is transmitted on selected antenna (see fig. 5 and col. 17, line 12--col. 18, line 45). Kadous also suggests that the symbol stream with the highest margin should be selected (col. 16). Since each symbol stream is determined based on SNR (for details see cols. 11-18); therefore Kadous discloses the claimed limitation of "selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin".

The examiner relies upon references, as a whole, to read on the claimed limitations. References' specific citations are to pinpoint pertinent passages to aid in the understandings of the reference as applied to the particular claimed elements.

With all the reasons stated above, the rejection is deemed proper and still stands.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 2, 4-8, 10, 13, 15-19, 21, 24, 26-30, 32, 35, 37-41, 43, 46, 48-52, 54 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Malaender (US-2003/0223391) in view of Kadous (US-6,801,580).

Regarding claims 4, Malaender teaches a method comprising:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach selecting a constellation for transmission on the active antennas where said selecting the constellation for transmission on the active antennas comprises selecting different constellations two or more of the active antennas. However, Kadous teaches a similar method of "patial receiver processing techniques include a channel correlation matrix inversion (CCMI) technique (which is also referred to as a zero-forcing technique) and a minimum mean square error (MMSE) technique" (see col. 20, lines 29-37); thus, making it analogous art since it is in the same field of endeavor. Kadous further teaches selecting a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) where said selecting the constellation for transmission on the active antennas comprises selecting different

constellations two or more of the active antennas (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 7, Malaender teaches a method comprising:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 15, Malaender teaches an apparatus (fig. 1B) comprising:

a processor (fig. 1B, 140) operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach wherein the processor is operative to select a constellation for transmission on the active antennas and select different constellations two or more of the active antennas. Kadous further teaches wherein the processor (col. 21, lines 3-11) is operative to select a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) and select different constellations two or more of the active antennas. (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 18, Malaender teaches an apparatus (fig. 1B) comprising:

a processor (fig. 1B, 140) operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach where the processor is operative to select a constellation for transmission on the active antennas and select an

optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where the processor (col. 21, lines 3-11) is operative to select a constellation for transmission on the active antennas and select an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-16). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 26, Malaender teaches an apparatus (fig. 1B) comprising:

a processor (fig. 1B, 140) including means for selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium. But, Malaender fails to expressly teach means for selecting a constellation for transmission on the active antennas including means for selecting different constellations two or more of the active antennas. Kadous further teaches means for selecting a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) including means for selecting different constellations two or more of the active antennas (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received

symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 29, Malaender teaches an apparatus (fig. 1B) comprising:

a processor (fig. 1B, 140) including means for selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium. But, Malaender fails to expressly teach where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 37, Malaender teaches a system (fig. 1) comprising:

a propagation medium (fig. 1A, 130);

a first transceiver including a plurality of available antennas (fig. 1A; antennas 111a-m);

a second transceiver including a plurality of available antennas (fig. 1A; antennas 121a-n);

a processor (fig. 1B, 140) operative to determine higher-order statistics of a propagation medium from signals received from the plurality of available antennas at the first transceiver ([0046]-[0047]); and antennas selection module operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0046]-[0047]).But, Malaender fails to expressly teach where the processor is operative to select a constellation for transmission on the active antennas and select different constellations two or more of the active antennas. Kadous further teaches where the processor (col. 21, lines 3-12) is operative to select a constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) and select different constellations two or more of the active antennas (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 40, Malaender teaches a system (fig. 1) comprising:

a propagation medium (fig. 1A, 130);

a first transceiver including a plurality of available antennas (fig. 1A; antennas 111a-m);

a second transceiver including a plurality of available antennas (fig. 1A; antennas 121a-n);

a processor (fig. 1B, 140) operative to determine higher-order statistics of a propagation medium from signals received from the plurality of available antennas at the first transceiver ([0046]-[0047]); and

antennas selection module operative to select a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0046]-[0047]). But, Malaender fails to expressly teach where the processor is operative to select an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin. Kadous further teaches where the processor (col. 21, lines 3-12) is operative to select an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 48, Malaender teaches a computer program [0054] comprising the steps of:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach selecting a constellation for transmission on the active antennas where said selecting the constellation for transmission on the active antennas comprises selecting different constellations two or more of the active antennas. Kadous further teaches selecting a constellation for transmission on the active antennas where said selecting the constellation for transmission on the active antennas (col. 17, lines 40-59; for more details see fig. 5, cols. 16-18) comprises selecting different constellations two or more of the active antennas (col. 14, lines 6-10, for more details see fig. 4 and cols. 14-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claims 51, Malaender teaches a computer program [0054] comprising the steps of:

selecting a subset of active antennas from a plurality of available antennas in an multi-element antenna system based on higher-order statistics of a propagation medium ([0043]-[0051]; described as "channel coefficient matrix"). But, Malaender fails to expressly teach where said selecting comprises selecting an optimum number of

antennas to maximize a minimum signal-to-noise (SNR) margi. Kadous further teaches where said selecting comprises selecting an optimum number of antennas to maximize a minimum signal-to-noise (SNR) margin (col. 16, lines 15-33; for more details see cols. 11-18). Therefore, it would have been obvious to one of ordinary skill in the art at the time the applicant's invention as taught by Kadous in the method of Malaender in order to "process a number of received symbol streams in a MIMO system with multipath channels such that improved performance may be achieved when using successive interference cancellation (SIC) receiver processing" (see SUMMARY).

Regarding claim 2, 13, 24, 35, 57 and 46, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37, 40 and 48 respectively. Malaender further teaches wherein the higher-order statistics comprise second-order statistics of the propagation medium ([0046]-[0047]).

Regarding claim 5, 16, 27, 38 and 49, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Kadous further teaches wherein the multi-element antenna system comprises a multiple-in multiple-out (MIMO) system (see abstract).

Regarding claim 6, 17, 28, 39 and 50, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Malaender further teaches

wherein said selecting comprises selecting the subset of active antennas based on correlation matrices among the active antennas ([0046]-[0047]).

Regarding claim 8, 19, 30, 41 and 52, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Malaender further teaches wherein said selecting comprises selecting the subset of active antennas based on a fixed data rate [0018].

Regarding claim 10, 21, 32, 43 and 54, Malaender and Kadous disclose all the limitations of claims 4, 15, 26, 37 and 48 respectively. Kadous further teaches allocating substantially equal power to each of said active antennas (col. 15, lines 63-67).

Reasons for Allowance

2. Claims 9, 11, 20, 22, 31, 33, 42, 44, 53, 55, 58 and 59 are allowed.

The following is a statement of reason for the indication of allowance:

Claims 9, 11, 20, 22, 31, 33, 42, 44, 53, 55, 58 and 59 are allowed with the same reasons set forth in the Office Action mailed 05/01/2006 (page 13).

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Hottinen discloses "The parallel transmission via a plurality of antenna elements in transceiver and terminal enables a reduction of Eb/No (Eb=energy per bit; No=noise power density per Hz) requirements for achieving data rates associated with higher order constellations like 8PSK, 16QAM, or 64QAM" (see specification).

6. **THIS ACTION IS MADE FINAL**.

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Huy Q Phan whose telephone number is 571-272-7924. The examiner can normally be reached on 8AM-6PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, George Eng can be reached on 571-272-7495. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

GEORGE ENG
SUPERVISORY PATENT EXAMINER

Examiner: Phan, Huy Q. AU: 2617 Date: 10/04/2006